Brüel & Kjær

2307

Level Recorder

valid from serial no. 377302

037–0107

Service

2307

Level Recorder

valid from serial no. 377302

037–0107

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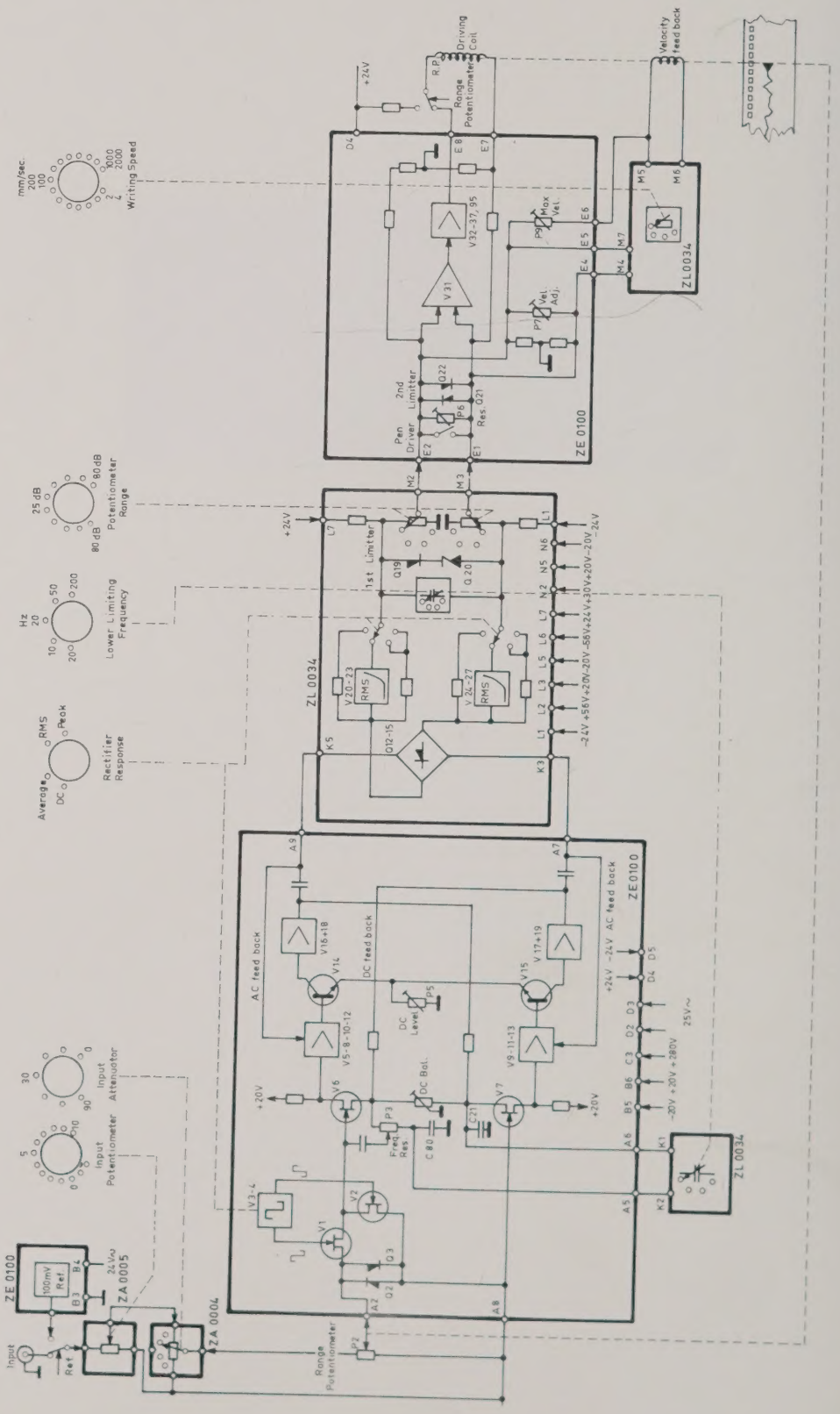
Simplified Diagram of the Recorder Amplifier



The Level Recorder Type 2307 consists mainly of a Recording Amplifier, an Electro-dynamic Writing System, a Paper Drive System and a Power Supply.

RECORDING AMPLIFIER

a. Input Amplifier

The input of the Level Recorder is unsymmetrical. The signal is first fed through the continuously variable INPUT POTENTIOMETER and then to the calibrated INPUT ATTENUATOR. Due to stray capacitance in the INPUT POTENTIOMETER the frequency response at the highest frequencies will be affected if the INPUT POTENTIOMETER is not set at position "10".

The calibrated INPUT ATTENUATOR enables the input signal to be accurately attenuated in six 10 dB steps to within ±0.2 dB.

From the INPUT ATTENUATOR the signal is fed to the Range Potentiometer. In the Range Potentiometer there are precision resistors connecting the 216 silver lamellae that make contact with the slider which is attached to the pen drive. The Range Potentiometer sets the dynamic range and response of the Level Recorder.

The pick off voltage from the slider is fed to an electronic chopper operating at 1 kHz. The chopper consists of two Field Effect Transistors (FET's) which are switched "on" and "off" 1000 times every second.

They are switched in antiphase and when they are switched "on" one passes the signal to the AC input amplifier and the other shortcircuit the input of the amplifier to ground during the remaining time of the switching cycle. Their chopping function is selected only when the Level Recorder is switched to record DC levels.

In the other three positions of the RECTIFIER RESPONSE selector a fixed −20 V is applied to the base of V 3 via R 36 locking the multivibrator in the state where the signal is allowed to proceed to the AC input amplifier.

The balanced input amplifier is DC coupled and provided with both AC and DC feed-back. The AC gain is approx. 70 dB.

b. Rectifier

The output from the input amplifier is applied to a bridge type full wave rectifier. The RECTIFIER RESPONSE networks are symmetrically disposed with respect to ground which ensures that the resolving power in the pen drive system is maintained for both rising and falling signals.

The specially designed rectifier circuit can be switched to measure either the true RMS, the arithmetic average or half the peak to peak value of the input signal.

RMS detection makes use of the highly accurate principle of a biased diode and transistor which performs to within ± 0.5 dB, in this case up to a crest factor of 10.

Following the rectifier circuit is the LOWER LIMITING FREQUENCY response circuit which has an initial effect on the averaging of the measured signal.

This circuit determines the lowest frequency to which the Level Recorder will respond linearly. It can be set to either "2", "10", "20", "50" or 200 Hz by the selector O 2. LOWER LIMITING FREQUENCY. At each of these roll-off frequencies the response of the Level Recorder drops by 0.3 dB.

c. Output Amplifier

The driving system is protected from being over driven by the first limiter (Q 18, 19 and 20). The threshold of the limiter is designed so that the drive system reaches full driving power when the signal fluctuation reaches its limit.

The output signal from the first limiter (DC) is compared with a built-in balanced DC reference voltage to produce a difference signal which is used to drive the output amplifier via a second limiter.

This difference signal is attenuated in steps by an attenuator marked POTENTIOMETER RANGE. The attenuator setting determines the resolving power of the Recorder which is the ability to faithfully follow detail fluctuations in the signal level.

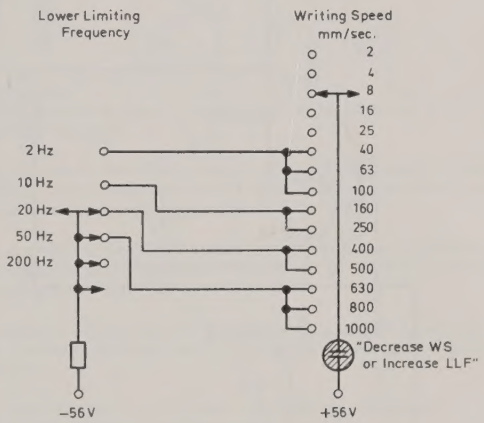
From the POTENTIOMETER RANGE attenuator the signal is fed to the second limiter. The reason for the second limiter is to ensure that the drive signal to the output amplifier section is independent of the magnitude of the servo error signal once it has reached a certain value.

This means that the signal to the output amplifier section will remain equal to, or less than, a fixed value.

The output amplifier consists of an integrated circuit DC amplifier and a push-pull DC power amplifier. This latter stage operates as a type of single ended push-pull amplifier. From a special winding on the moving coil of the electromagnetic drive system a velocity dependent signal is induced.

The signal is introduced as negative feed back to the input of the output amplifier section. The feed back signal will completely control the output signal from this section as long as the signal from the second amplitude limiter has reached its constant value, which is the case when the limiter is in action.

The speed of the writing system, and hence its averaging effect on the recorded levels, can be adjusted according to the figures around the WRITING SPEED control knob.



The stability of the complete system is determined by the combined settings of WRITING SPEED, LOWER LIMITING FREQUENCY and POTENTIOMETER RANGE.

Is the correct setting of POTENTIOMETER RANGE selected for the Range Potentiometer in use, overshoot and instability in the system could be caused by selecting too high a WRITING SPEED in relation to the setting of LOWER LIMITING FREQUENCY.

A lamp marked "Decrease WS or Increase LLF" will light up if the limit for a stable operation is exceeded.

d. Removal of the Range Potentiometer

When the Range Potentiometer is removed great care must be taken not to damage the slider. By having the writing system all the way to the right damaging the slider is minimized.

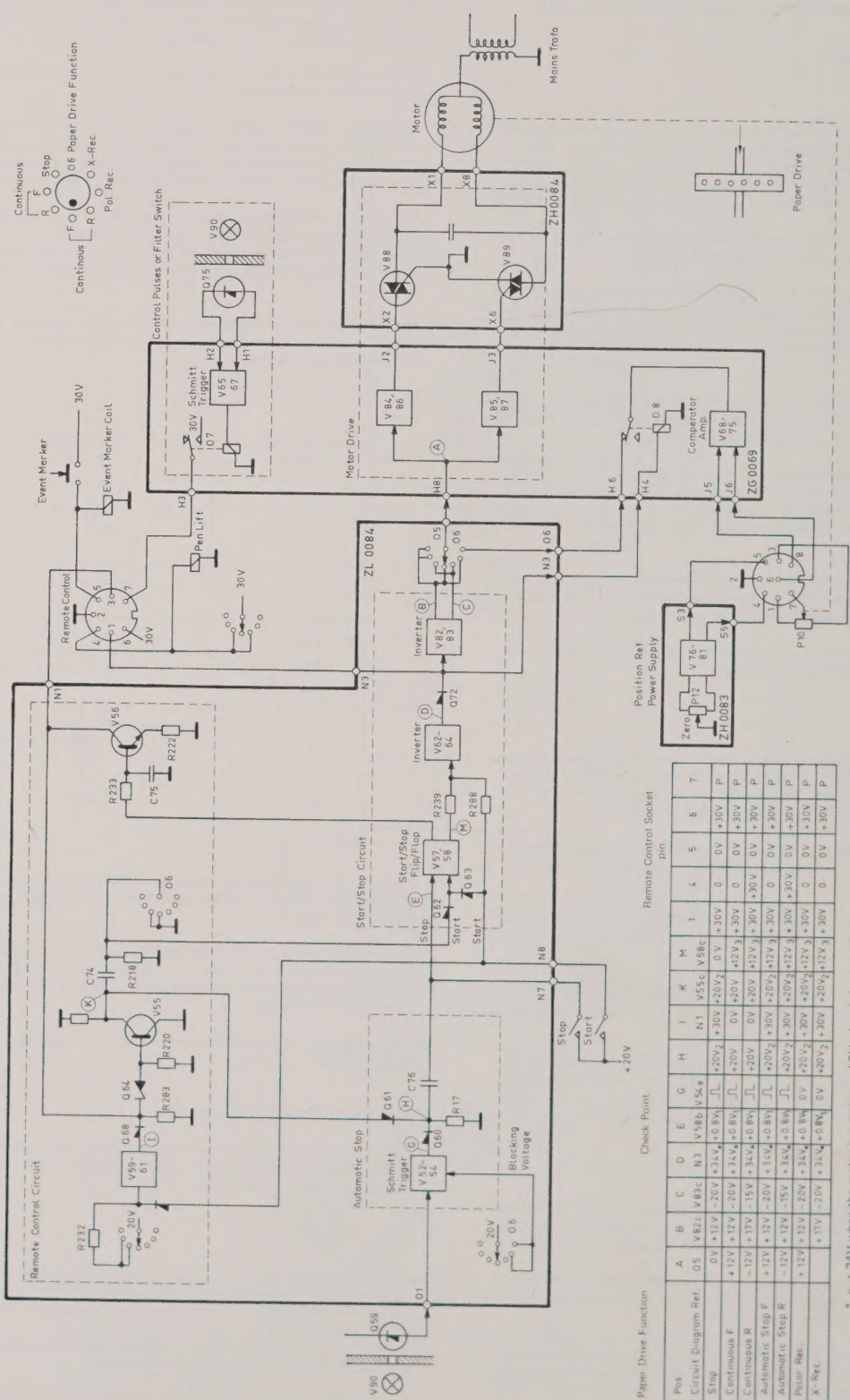
1. Power "ON"

When the screw, by which the Range Potentiometer is mounted in the unit, is loosened a microswitch disconnect the moving coil from the output amplifier and connect the coil to the fixed + 24 V supply via a resistor (R 152).

The writing system will then go to the right and the current is limited to 1/10 of the current normally supplied by the amplifier.

The function is independent of the position of the Standby/Operation selector.

Simplified Diagram of the Control Circuit



Paper Drive Function

Pos.	A	B	C	D	E	G	H	I	K	M	1	4	5	6	7
Circuit Diagram Ref.	Q5	V82c	V83c	N3	V58b	V54e		N1	V55c	V58c					
Stop	0V	+12V	−20V	+34V*	+0.8V$_1$	⊓	+20V$_2$	+30V	+20V$_2$	0V	+30V	0	0V	+30V	P
Continuous F	+12V	+12V	−20V	+34V*	+0.8V$_1$	⊓	0V	+12V	+20V	+12V$_3$	+30V	0	0V	+30V	P
Continuous R	−12V	+17V	−15V	+34V*	+0.8V$_1$	⊓	0V	+20V	+20V	+12V$_3$	+30V	+30V	0V	+30V	P
Automatic Step F	+12V	+12V	−20V	+34V*	+0.8V$_1$	⊓	+20V$_2$	+30V	+20V$_2$	+12V$_3$	+30V	0	0V	+30V	P
Automatic Step R	−12V	+12V	−15V	+34V*	+0.8V$_1$	⊓	+20V$_2$	+30V	+20V$_2$	+12V$_3$	+30V	+30V	0V	+30V	P
Polar Rec.	+12V	+12V	−20V	+34V*	+0.8V$_1$	0V	+20V$_2$	+30V	+20V$_2$	+12V$_3$	+30V	0	0V	+30V	P
X-Rec.		+17V	−20V	+34V*	+0.8V$_1$	0V	+20V$_2$	+30V	+20V$_2$	+12V$_3$	+30V	0	0V	+30V	P

Remote Control Socket pin

Check Point

* ≈ + 34V when the motor is running and 0V when it is stopped
1 ≈ + 0.8V when the motor is running and 0V when it is stopped
2 ≈ when the start knob is activated
3 ≈ when the motor is running
P ≈ pulses

1.2 Paper Drive System

In the paper drive system the Start, Stop, Forward and Reverse functions of the meter is controlled by electronically switch circuits. The motor is a reversible synchronous motor with very short start and stop times thus avoiding the use of mechanical clutches.

When the Level Recorder is switched to one of the "Cont. Record" or "Automatic Stop" positions and a power failure should occur the paper drive system will automatically get "stop" information when Level Recorder start up again.

Stop
The start/stop flip-flop is locked in the stop position by +20 V supplied via the selector O 6 and resistor R 230. The paper can stepwise be moved forward by pressing START.

Continuous Recording, forward:
The start/stop flip-flop is set by pressing START. This will change the output from the inverter V 62-64 from 0 to + (check point "B") and the motor will start in forward direction.

+20 V applied to the inverter V 59-61 through a section of PAPER DRIVE FUNCTIONS will change the voltage in check point "1" from + to 0. This 0 is inverted in V 55 giving a blocking voltage to the gate for automatic stop.

The paper drive can be stopped by pushing the button STOP.

Continuous Recording, reverse:
As above mentioned except that a section of PAPER DRIVE FUNCTIONS select the – output from the inverter V 82,83 (check point "C") causing the motor to move in the opposite direction. Another section of PAPER DRIVE FUNCTIONS activates the pen lift relay.

Automatic Stop, forward:
The start function operates as for Continuous Recording but the blocking voltage to the gate for automatic stop is removed in this position of PAPER DRIVE FUNCTIONS.

On one side of the paper wheel is a lamp which, through a slot in the wheel, will give light to a photodiode, when the wheel is in the correct stop position. The signal from the photodiode activates a Schmitt-trigger the output of which, via the gate, is applied to the start/stop flip-flop.

Automatic Stop, reverse:
As above except that the – output from the inverter V 82,83 is used to operate the motor.

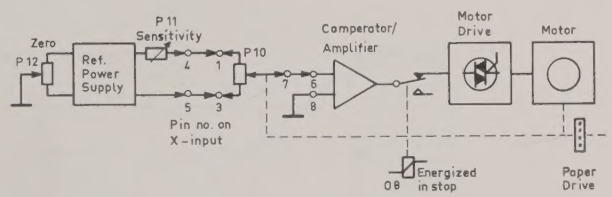
The pen lift relay is also activated.

Polar Recording:
This position is used when the Level Recorder is used with the Turntable Type 3921 or 3922.

The built-in stop function in the Turntable will stop both units when the Turntable has completed one revolution.

Both units can be started from either the Turntable or the Level Recorder.

By pushing STOP on the Level Recorder both units can be stopped. To continue the sweep START on the Level Recorder should be pushed.



X-Recording:
In this position the paper drive system can be controlled by an external applied voltage ramp.

The principle of operation is based on "Error reducing system" whereby the existence of a potential difference across a differential amplifier results in a proportional voltage across a secondary circuit.

The secondary circuit forms a part of the system which is designed to reduce the originally applied potential difference across the differential amplifier thus closing the loop.

A variable floating voltage for use across P 10 is available across pin 4 and 5. The potential difference can be varied by adjusting P 11 X-Recording Sensitivity.

The absolute level of this potential difference compared to ground is adjustable by means of P 12, X-Recording Zero.

The secondary circuit comprises the meter control which via the paper drive rotate the wiper of P 10 in order to produce a sliding voltage pick off at pin 7. This voltage is applied to one input of a differential amplifier where it is compared against the voltage applied to the other input (ground). If there is a potential difference then the amplifier will continue to activate the motor circuit until this difference, within the resolution of the system, is reduced to zero.

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3.1. Voltage

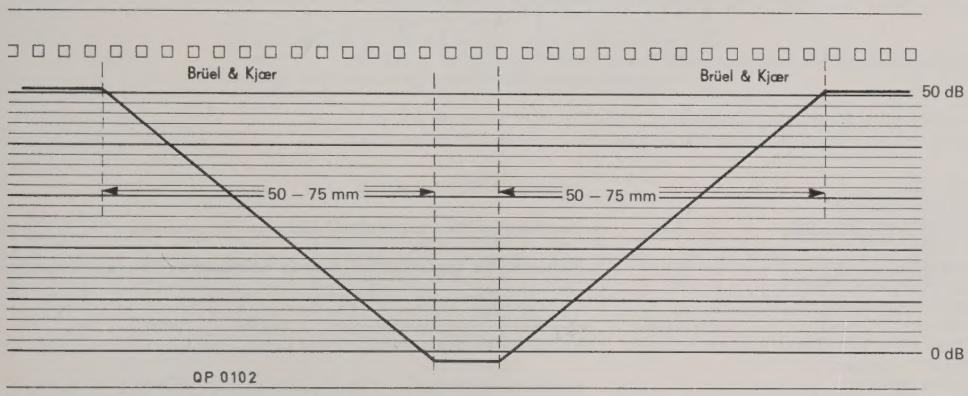
Before any repair or when a fault has been found and corrected the Level Recorder should be tested according to item 3.2 to 3.4 to make sure that the basic function is operative.

DC Voltage

+ 20 V	F 8	ZG 0069
– 20 V	F 9	
+ 24 V	D 4	ZE 0100
– 24 V	D 5	
+ 30 V	O 4	ZL 0034
+ 56 V	G 4	ZG 0069
– 56 V	G 5	
+ 235 V	C on V 30	ZE 0100

AC Voltage

24 V ~ F 1,2	ZG 0069
24 V ~ B 4	ZE 0100
25 V ~ D 2,3	ZE 0100
50 V ~ G 1,2	ZG 0069



3.2. Writing Speed

PEN DRIVE: "On"
INPUT ATTENUATOR: "0"
INPUT POTENTIOMETER: "10"
WRITING SPEED: "8 mm/sec"
LOWER LIM. FREQ.: "200 Hz"
RECTIFIER RESPONSE: "RMS"
POTENTIOMETER RANGE: "50 dB"
WRITING WIDTH: "50 mm"
PAPER DRIVE FUNCTION: "Cont. Forward"
PAPER SPEED: "10 mm/sec"
Paper: QP 0102 (QP 0224)

Input signal: 4 V, 1000 Hz.

Start the paper drive by pressing START and remove the input signal while the paper is running.

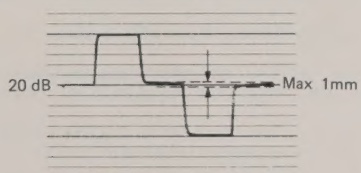
When the sapphire has reached the 0 dB line apply the signal again.

The paper length for a movement of the sapphire from 50 dB to 0 or from 0 to 50 dB should be 62 mm.
Tolerance ± 20%. Measured on the paper 50 – 75 mm.
If necessary adjust P 7. Vel. Adj.

Possible reason for faults: Defective feed-back coil
Unbalanced Input amp. Check 3.6
Unbalanced Output amp. Check 3.5

WRITING SPEED to "1000 mm/sec"
PAPER SPEED to "100 mm/sec"

Check as above.
Tolerance: ± 20%. Measured on the paper 4 – 6 mm.
If necessary adjust P 9. Max. Vel.



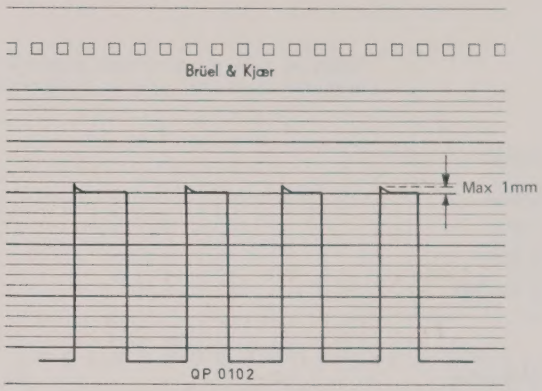
3.3. Resolving Power

PEN DRIVE: "On"
INPUT ATTENUATOR: "10"
INPUT POTENTIOMETER: "10"
WRITING SPEED: "16 mm/sec"
LOWER LIM. FREQ.: "200 Hz"
RECTIFIER RESPONSE: "RMS"
POTENTIOMETER RANGE: "50 dB"
WRITING WIDTH: "50 mm"
PAPER DRIVE FUNCTION: "Cont. Forward"
PAPER SPEED: "1 mm/sec"
Paper: QP 0102 (QP 0224)

Start the paper drive by pressing START and adjust the input voltage (at approx. 1 kHz) for a sapphire deflection to the 20 dB line.

Change INPUT ATTENUATOR to "0 dB" and back again to "10 dB". Thereafter to "20 dB" and back to "10 dB".

Check that the sapphire comes back to the 20 dB line. Tolerance: ± 0.5 mm.
Possible reason for faults: Incorrect setting of P 6. Check 3.4
Too low driving Power. Check 3.8
Unbalanced input Amp. Check 3.6
Unbalanced output amp. Check 3.5



3.4. Overshoot

PEN DRIVE: "On"
INPUT ATTENUATOR: "0"
INPUT POTENTIOMETER: "10"
WRITING SPEED: "800 mm/s"
LOWER LIM. FREQ.: "200 Hz"
RECTIFIER RESPONSE: "RMS"
POTENTIOMETER RANGE: "50 dB"
WRITING WIDTH: "50 mm"
PAPER DRIVE FUNCTION: "Cont. Forward"
PAPER SPEED: "1 mm/sec"
Paper: QP 0102 (QP 0224)

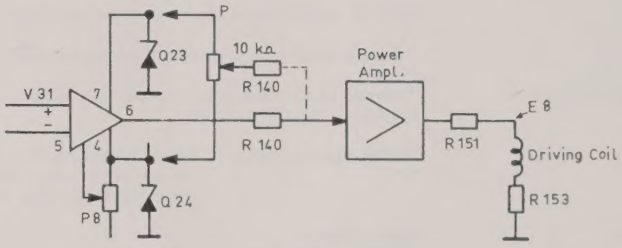
Input signal: 400 mV, 1000 Hz.

Start the paper drive by pressing START.

Disconnect the input signal and check the overshoot when the signal is applied again.

Overshoot: max. 1 mm.
If necessary adjust P 6. Resolution.
Whenever P 6 is adjusted check the resolution power, item 3.3.

Possible reason for fault: Writing speed too high. Check 3.2



3.5. Balance of Output Amplifier

PEN DRIVE: "Off"

Measure the DC voltage across the driving coil (measuring Point E 8): 0 V ± 0.5 V.

If necessary adjust P 8, Balance.

If it is impossible to adjust connecta 10 kΩ potentiometer "P" to the 12 V zener diodes as shown and connect the resistor R 140 to the slider.

Then adjust "P" for 0 V across the driving coil to see if the output stage alone can be balanced (adjustment range approx. ± 18 V).

If 0 V can be obtained now the most possible reason for a fault is V 31.

3.6. Balance of Input Amplifier

PEN DRIVE: "Off"
INPUT ATTENUATOR: "0"
INPUT POTENTIOMETER: "10"

Measure the DC voltage from R 66,68 to R 67,69: 0 V ± 0.5 V.
If necessary adjust P 4, DC balance.

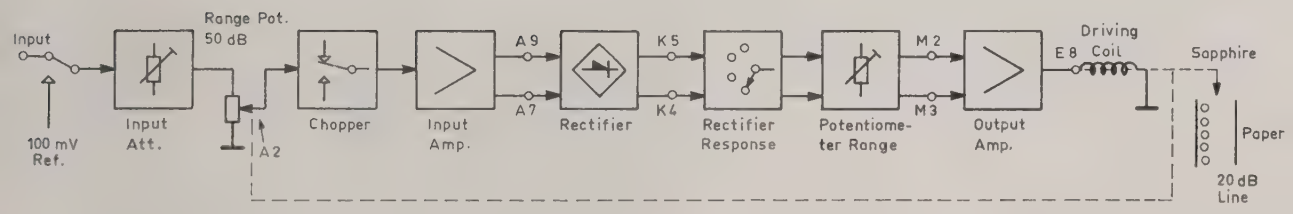
If it is impossible to adjust check the voltages through the stages, where approx. 0 V should be obtainable when measuring from one point in the upper part to the corresponding point in the lower part of the symmetrical input amplifier.

Set the sapphire to the outer right position.
Measure the DC voltage from R 66,68 to ground: approx. 125 V.

In order to overload the amplifier apply a signal 10 V, 1000 Hz to "Input" and note DC voltage variation: max. 2 V.

If necessary adjust P 5, DC level to give the same reading with and without input signal.
P 5 should never be turned to give zero Ω.

If for any reason the FET's V 6 and V 7 has to be replaced turn P 5 to max. resistance before the Level Recorder is switched on to prevent any transistor break-down in the output stage.



3.7. Sensitivity

PEN DRIVE: "On"
INPUT ATTENUATOR: "0"
INPUT POTENTIOMETER: "10"
WRITING SPEED: "100 mm/sec"
LOWER LIM. FREQ.: "20 Hz"
RECTIFIER RESPONSE: "RMS"
POTENTIOMETER RANGE: "50 dB"
WRITING WIDTH: "50 mm"
PAPER DRIVE FUNCTION: "Cont. Forward"
PAPER SPEED: "1 mm/sec"
Paper: QP 0102 (QP 0224)

Input signal: Exactly 100 mV, approx. 1000 Hz.

Start the paper drive by pressing START.

a. Check the regulation range of INPUT POTENTIOMETER.
Deflection for position "0": approx. 15 dB.
Deflection for position "10": approx. 25 dB.

If the sensitivity is too low turn P 6, Resolution to max. resistance and check the signal levels.

Input signal	Measuring point A 2	A 7.9	Cathode Q 12	Anode Q 15	E 8
100 mV	app. 3 mV RMS	10 V RMS	approx. + 9 V	approx. –9 V	0 V
1000 Hz	1000 Hz	1000 Hz	DC	DC	DC

After repair check Resolving Power 3.2 and Overshoot 3.3.

b. Adjust INPUT POTENTIOMETER for a deflection to the 20 dB line

Depress "100 mV Ref." and check the deflection. 19.9 – 20.1 dB.
If necessary adjust P 2, 100 mV Ref.

3.8. Max. Driving Power

PEN DRIVE: "On"
INPUT ATTENUATOR: "0"
INPUT POTENTIOMETER: "10"
WRITING SPEED: "2 mm/sec"
LOWER LIM. FREQ.: "200 Hz"
RECTIFIER RESPONSE: "RMS"
POTENTIOMETER RANGE: "50 dB"
WRITING WIDTH: "50 mm"
PAPER DRIVE FUNCTION: "Cont. Forward"
PAPER SPEED: "1 mm/sec"
Paper: QP 0102 (QP 0224)

Input signal. 10 V, 1000 Hz.

Start the paper drive by pressing START.

Connect a DC voltmeter across the driving coil measuring point E 8.

When the input signal is disconnected the voltage should be 1.3 – 2.0 V during the sapphire movement from the 50 dB to 0 dB line. For 100 mm writing width the voltage is not to exceed 4 V.

As soon as the sapphire stops at the 0 dB line the voltage increase to 18 – 20 V.

If the voltage is higher than 2 V during the movement it indicates that the mechanical friction in the writing system is too high. Check item 4.1.

3.9. Rectifier Response

PEN DRIVE: "On"
INPUT ATTENUATOR: "0"
INPUT POTENTIOMETER: "10"
WRITING SPEED: "100 mm/sec"
LOWER LIM. FREQ.: "20 Hz"
RECTIFIER RESPONSE: "RMS"
POTENTIOMETER RANGE: "50 dB"
WRITING WIDTH: "50 mm"
PAPER DRIVE FUNCTION: "Cont. Forward"
PAPER SPEED: "1 mm/sec"
Paper: QP 0102 (QP 0244)

Start the paper drive by pressing START.

Adjust the input signal at approx. 1000 Hz until the sapphire is on the 20 dB line

Switch RECTIFIER RESPONSE to "Average".
Sapphire deflection: 10.1 dB

Switch RECTIFIER RESPONSE to "Peak".
Sapphire deflection: 23 dB.

Disconnect the AC input signal and connect a DC voltage.
The DC voltage will give the same deflection when RECTIFIER RESPONSE is in position DC as an RMS voltage when RECTIFIER RESPONSE is in position RMS.

3.10. Frequency Response

a PEN DRIVE: "On"
INPUT ATTENUATOR: "0"
INPUT POTENTIOMETER: "10"
WRITING SPEED: "8 mm/sec"
LOWER LIM. FREQ.: "200 Hz"
RECTIFIER RESPONSE: "RMS"
POTENTIOMETER RANGE: "50 dB"
WRITING WIDTH: "50 mm"
PAPER DRIVE FUNCTION: "Cont. Forward"
PAPER SPEED: "1 mm/sec"
Paper: QP 0102 (QP 0224)

Start the paper drive by pressing START.

Adjust the input signal to approx. 1000 Hz until the sapphire is on the 40 dB line.

Check the frequency cut off for all positions of LOWER LIM. FREQ. with the signal frequency corresponding to the knob position.

Deflection: 40 dB ± 0.3 dB.

b. WRITING SPEED to "500 mm/sec"
LOWER LIM. FREQ. to "200 Hz"

Change the frequency to 200 kHz.

Deflection: 40 dB + 0.5 dB, −0.2 dB.
If necessary adjust P 3, Frequency response.

Check all positions of INPUT ATTENUATOR.
Attenuator step. 10 dB ± 0.2 dB.

3.11. Hum

PEN DRIVE: "On"
INPUT ATTENUATOR: "0"
INPUT POTENTIOMETER: "10"
WRITING SPEED: "100 mm/sec"
LOWER LIM. FREQ.: "10 Hz"
RECTIFIER RESPONSE: "Peak"
POTENTIOMETER RANGE: "8 dB"
WRITING WIDTH: "50 mm"
PAPER DRIVE FUNCTION: "Cont. Forward"
PAPER SPEED: "1 mm/sec"
Paper: QP 0102 (QP 0224)

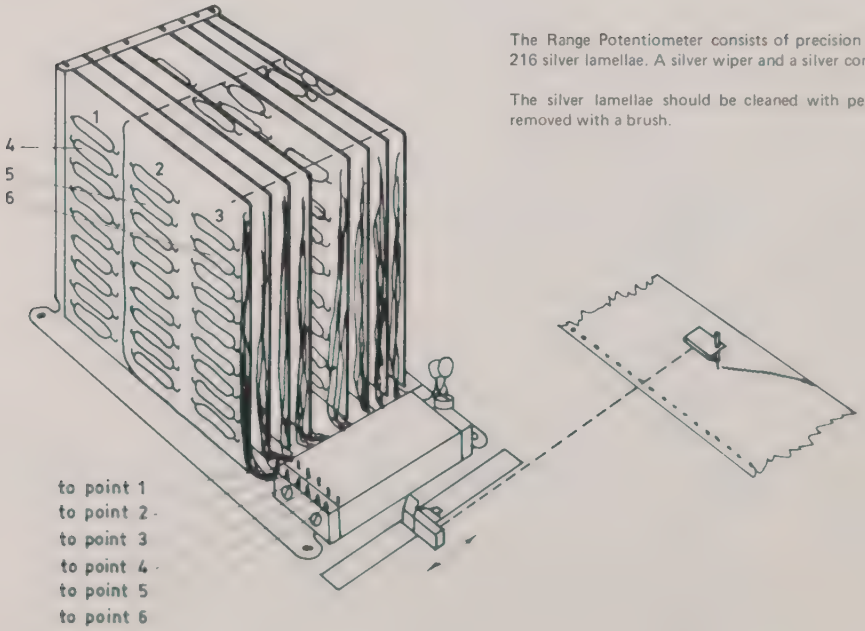
Start the paper by pressing START.

Input signal: 15 mV, 1000 Hz.

Change the frequency slowly towards the mains frequency and check the sapphire movement.

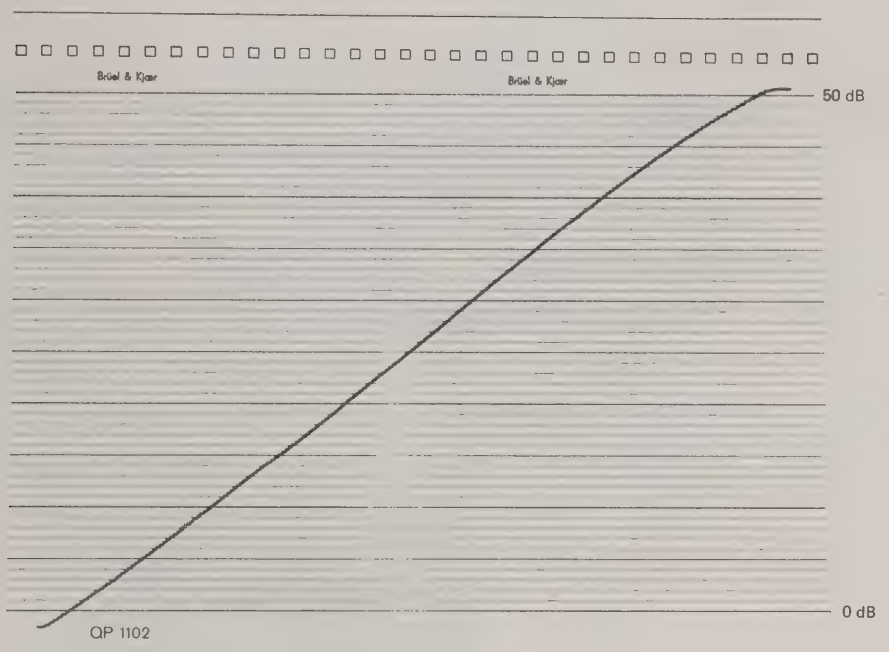
At approx. 2 Hz from the mains frequency a beat may occur, but must not exceed 0.5 mm.

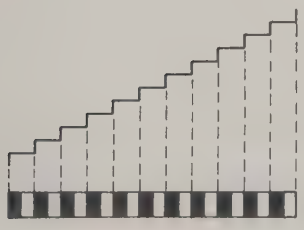
3.12. Check of Range Potentiometer



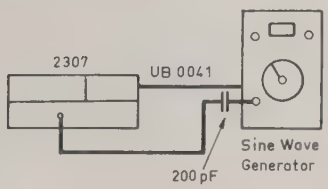
The Range Potentiometer consists of precision resistors connected to a contact strip built up of 216 silver lamellae. A silver wiper and a silver contact strip assure a high signal-to-noise ratio.

The silver lamellae should be cleaned with petrol and any metallic dust between the lamellae removed with a brush.



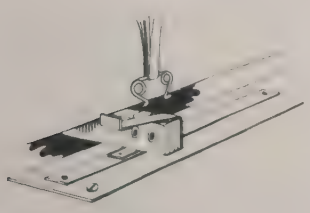


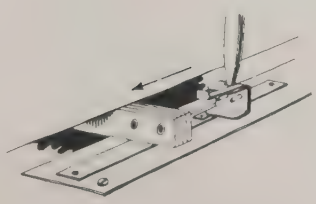
A detailed drawing of the lamellae of the potentiometer and the curve above.
As it can be seen on the drawing, one step on the curve correspond to the slider are moved from one lamellae to another.

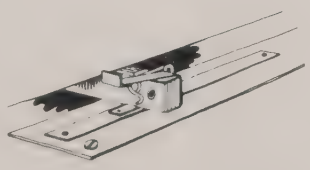


POTENTIOMETER RANGE: "50 dB"
RECTIFIER RESPONSE: "Peak"
LOWER LIM. FREQ.: "2 Hz"
WRITING SPEED: "1000 mm/sec"
PAPER SPEED: "1 mm/sec"
INPUT ATTENUATOR: "0 dB"
Paper: QP 1102
WRITING WIDTH: "100 mm"

Connect 2307 as the drawing shows above.
Adjust the input voltage (at approx. 20 kHz) for a pen deflection to just a little higher than 50 dB line. Turn the generator to approx. 20 Hz and check that the pen deflection is under 0 dB line.
Switch the generator to automatic scanning and start the Level Recorder.
The pen will ladder in steps with 6 dB/oct. as shown in the drawing above.







Replacement of the slider

Remove the Range Potentiometer.
Dismount the locking spring by use of slim pliers.
Dismount the defective slider and mount the new one.
Then the locking spring is put into position behind contact
After replacement regrind the slinder. This is done by placing a piece of the finest glass-paper between the lamellae and the slider and move the pen from side to side.

3.13. Paper Drive

a. PAPER DRIVE FUNCTION: "Stop"

Check that the paper move forward only if START is depressed.

b. PAPER DRIVE FUNCTION to "Cont. Forward"

Start the paper drive in forward direction by pressing START. The paper movement continue until STOP is depressed.

c PAPER DRIVE FUNCTION to "Cont. Reverse"

As b but reverse paper movement.

d PAPER DRIVE FUNCTION to "Aut. Stop F"

Align the white dot on the AUTOMATIC STOP adjustment wheel with the white dot on the paper drive wheel.

Insert a recording paper with preprinted frequency lines on the paper drive wheel positioning the start frequenzy f.inst. 10 Hz on the paper closly to the line drawn by the sapphire.

Run one chart by pressing START and fine adjust the AUTOMATIC STOP wheel for the exact frequency.

e PAPER DRIVE FUNCTION to "Aut. Stop R"

Run one chart and check the stop position.
Max. deviation between stop "Forward" and "Reverse": ± 1 mm.

f PAPER DRIVE FUNCTION to "Polar Recording"

Start the paper drive by START. The paper movement should continue until STOP is pressed.

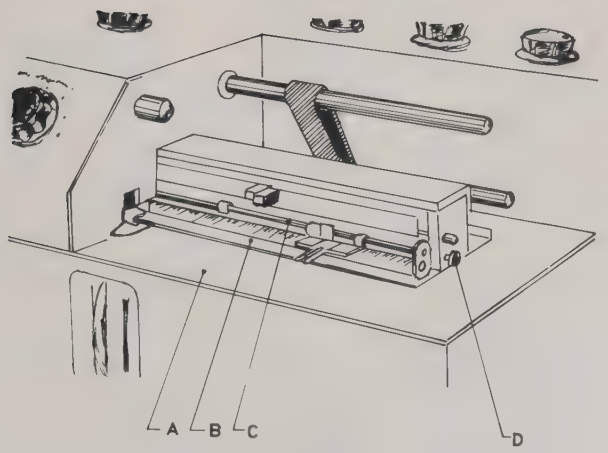
JP 0802 ext. view

g. PAPER DRIVE FUNCTION: "X-Rec."
PAPER SPEED = Not to exceed 3 mm/sec

An 8-pin DIN plug (B & K Type JP 0802) is wired as shown above and plugged into the "X-Input" socket.

Start the paper drive by pressing START and note where the paper stops automatically.

Manually move the paper wheel off this position and check that the paper automatically returns to the same position as soon as the paper wheel is released.



4.1. Writing System

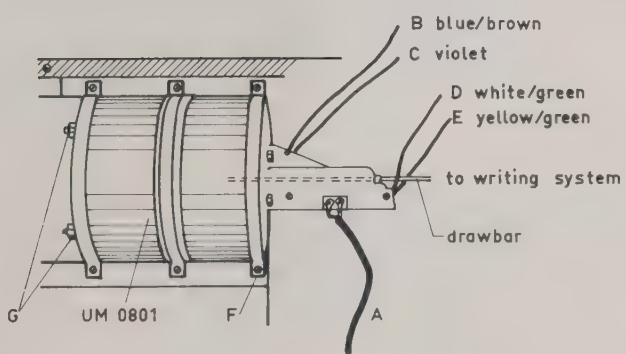
Cleaning

Remove pen and paper.
With a soft cloth and trichlorethylene remove any wax or waster matter from writing plate A and bottom plate B.
Also clean the guide bar C.

Adjustment of dB scale:

Set stylus to the position 0 dB on the paper and adjust the screw D for a corresponding reading on the metallic scale.

Note: Under no circumstances should oil be applied to the writing system.



4.2. Magnet System

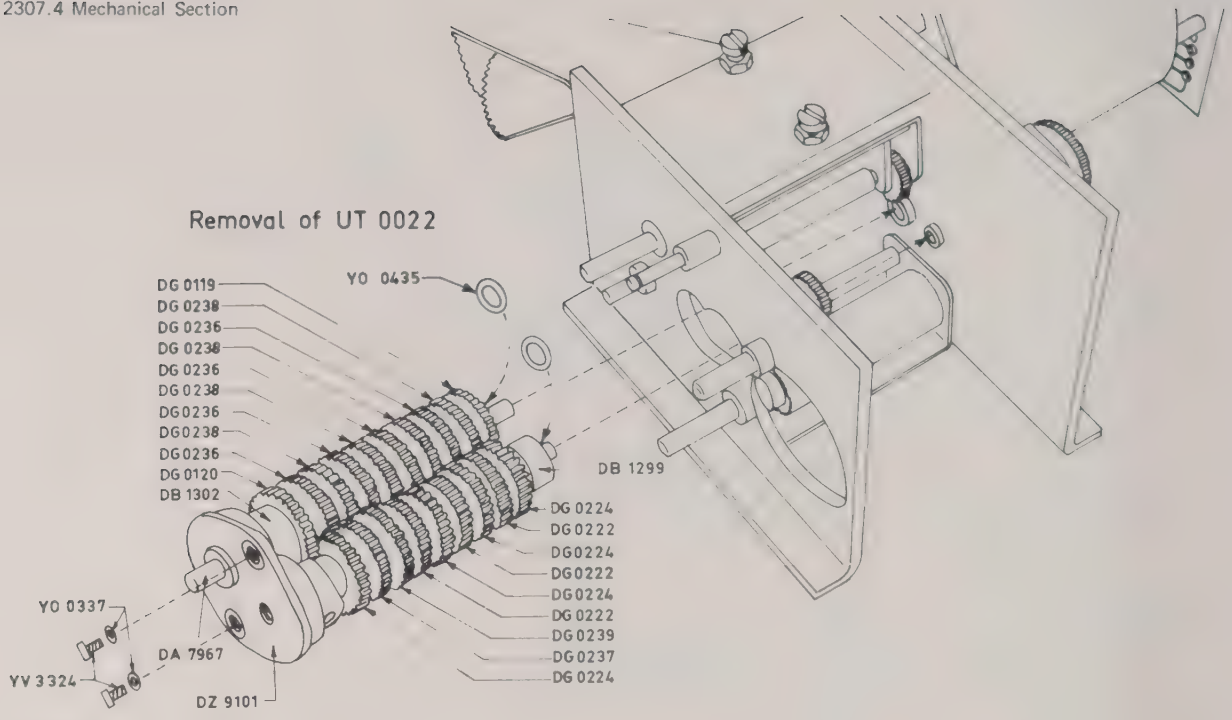
Removal of the Magnet system

Remove the writing Potentiometer.
Disconnect the mechanical connection between the magnet system and the writing system.
Move the drawbar so far to the left side as possible.
Place the instrument with the bottom upward.
Remove the bottom plate and the back plate.
Unsolder the five wires A – B – C – D – E.
Unscrew the six 5 mm screws F.
Loosen the four 6 mm nuts G.
The magnet system can now be removed
The assembling should take place in the reverse order.

Coil Resistance

Resistance in the coil: Driver coil. approx. 27 Ω
Feedback coil: approx. 1 kΩ

Note: Under no circumstances should oil be applied to the magnet system.

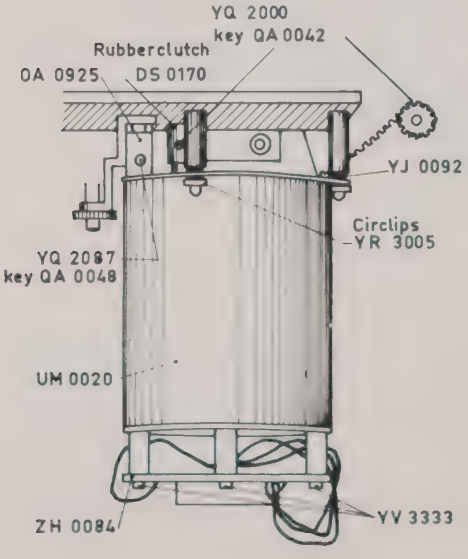


4.3. Gear Box

Removal of the Gear Wheels

Place the instrument with the left side downward.
Remove the bottom plate
Remove the cover on the right side of the instrument.
Dismount the chain wheel on drive shaft I and II (Allen key 1.5 mm).
Dismount the nylon gear wheels for adjustment to mains frequency.
Remove the two screws YO 0337.
The gear wheels can now be removed.

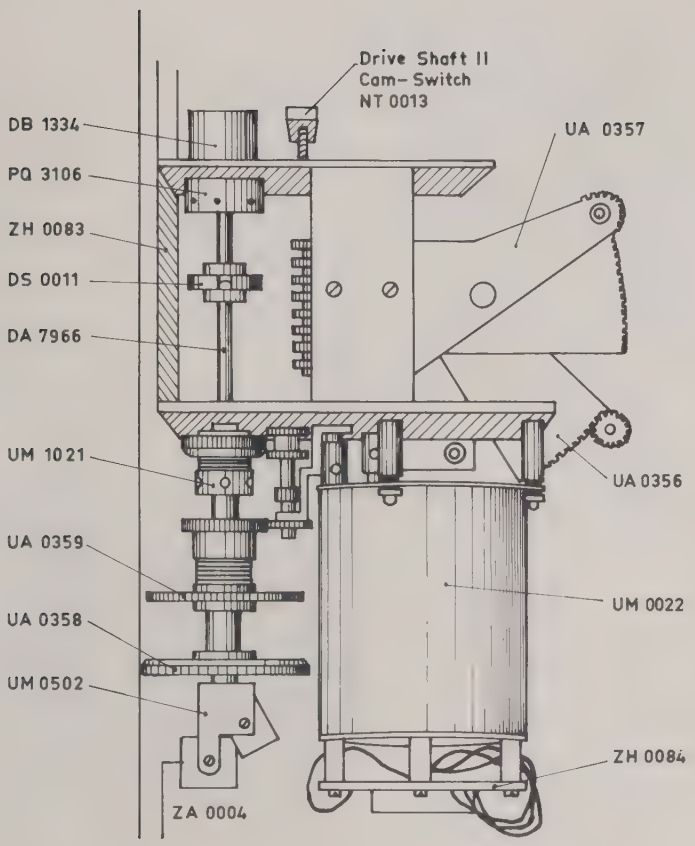
When assembling check that the face for the gear wheels don't touch each other.
The distance between the gear wheels can be adjusted by place or replace the space washer YO 0435.



4.4. Motor

Removal of the motor

Unsolder the four wires (white/blue – white/red – yellow – yellow) on ZH 0084
Remove the circuit board ZH 0084 by unscrewing the three screws YV 3333
Unscrew the allen screw YQ 2087 (Allen key 2 mm).
Remove the two circlips YR 3005
The motor can now be removed by pulling it downwards
When assembling remember the rubber clutch between the motor and the gear box



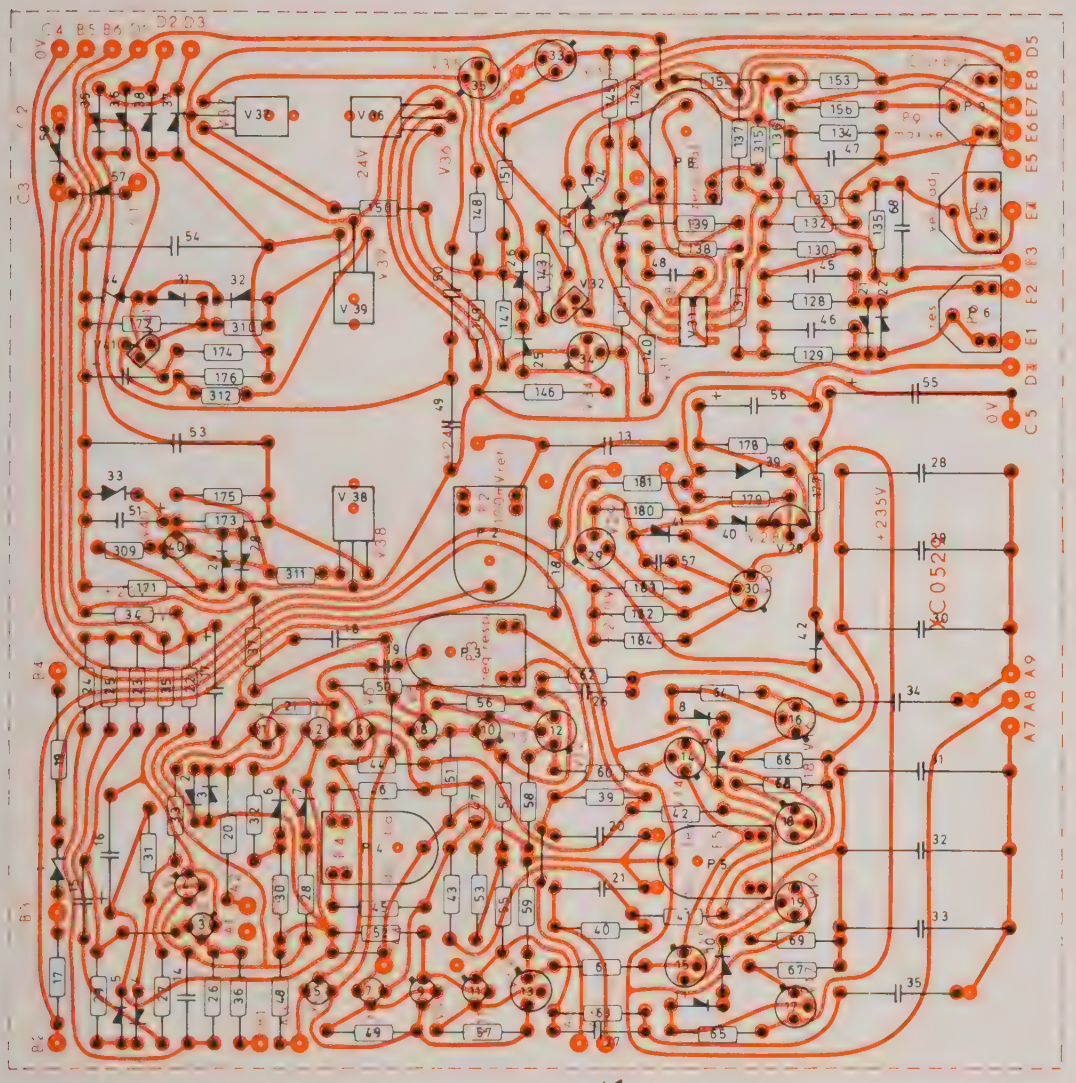
4.5. Friction Clutch

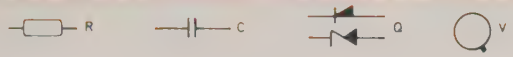
POWER: "On"
PAPER SPEED: "100 mm"

Place a pin tuck in an angle of 90 degrees in Drive Shaft II on the right side of the instrument.
Start the motor by pressing "Start".
Check that the clutch slips at a pressure of 200 g measured on the pin 10 cm from the center.

If necessary adjust UM 1021.

Layout Diagrams with Parts List



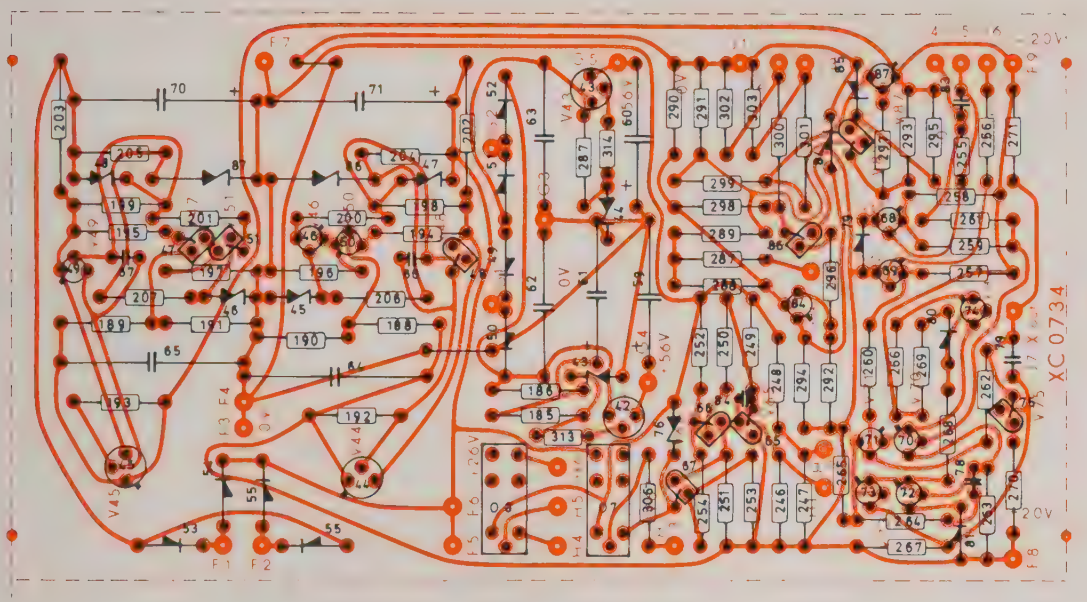


CIRCUIT DIAGRAM REF.	COMPONENT TYPE		STOCK REF	CIRCUIT DIAGRAM REF.	COMPONENT TYPE			STOCK REF.
C 13	Electrolytic Bip.	10 µF/ 70 V	CE 0517	C 57	Ceramic	27 pF/400 V		CK 1270
C 14,15	Polyester	12 nF/250 V	CS 0002	C 68	Polycarbonate	68 nF/250 V		CS 0011
C 16,17	Electrolytic	25 µF/ 25 V	CE 2002					
C 18	Polyester	0.1 µF/250 V	CS 0013	P 2	Trimmer	Carbon 0.25 W	10 kΩ	PG 3108
C 19	Ceramic	1 pF/400 V	CK 0100	P 3			50 kΩ	PG 3509
C 20,21	Polycarbonate	0.47 µF/100 V	CS 0335	P 4			470 Ω	PG 1500
C 26,27	Ceramic	1 pF/400 V	CK 0100	P 5			5 kΩ	PG 2507
C 28-33	Polyester	2 µF/250 V	CS 0028	P 6			250 kΩ	PG 4253
C 34-35		0.68 µF/250 V	CS 0023	P 7			50 kΩ	PG 3511
C 45-46	Polystyrene	6.2 nF/ 63 V	CT 1510	P 8			10 kΩ	PG 3108
C 47	Polycarbonate	68 nF/250 V	CS 0011	P 9			500 kΩ	PG 4510
C 48	Polystyrene	1 nF/ 63 V	CT 1132					
C 49,50	Polycarbonate	0.22 µF/100 V	CS 0339	Q 1	Zener	5.0-6.2 V/0.28 W	ZG 5.6	QV 1105
C 51,52	Electrolytic	5 µF/ 70 V	CE 0200	Q 2,3	Silicon	200 V/ 40		QV 0022
C 53,54		400 µF/ 40 V	CE 0417	Q 4-7			1 N 4004	QV 0237
C 55		8 µF/350 V	CE 0802	Q 8-11		400 V/ 1 A	1 N 4004	QV 0237
C 56		4 µF/250 V	CE 2034					

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
Q 21,22	Silicon	400 V/	1 A	1 N 4004	QV 0237
Q 23,24	Zener	11-13V/0.25 W		MZ 716 A	QV 1117
Q 25,26	Silicon	400 V/	1 A	1 N 4004	QV 0237
Q 28,29		400 V/	1 A	1 N 4004	QV 0237
Q 31,32		400 V/	1 A	1 N 4004	QV 0237
Q 33,34	Zener	21.6-26.4 V/0.25 W		1 N 723	QV 1005
Q 35-38	Silicon	400 V/	1 A	1 N 4004	QV 0237
Q 39	Zener	143 -158 V/	1 W	1 N 3048 B	QV 1317
Q 40 42	Silicon	400 V/	1 A	1 N 4004	QV 0237
Q 57,58		1200 V/150 mA		BYX 10	QV 0025
R 17	Carbon	1/3 W	10%	500 Ω	
R 18		-	5%	12 kΩ	
R 19		1/2 W	10%	2 kΩ	
R 20				10 kΩ	
R 21		1/3 W	-	4MΩ	
R 22,23		-	5%	3.9 kΩ	
R 24				63KΩ	
R 25			-	82 kΩ	
R 26,29		-		10 kΩ	
R 30,31		-	-	4.7 kΩ	
R 32,33		-		1MΩ	
R 34				550 Ω	
R 35		-		1.25 kΩ	
R 36	-		5%	33 kΩ	
R 37		-		96 Ω	
R 39-40	Metal	1/4 W	2%	330 kΩ	
R 41-44	Carbon	1/3 W	1%	2.2 kΩ	RF 0307
R 45-46	Carbon	1/3 W	2%	2.2 kΩ	
R 47	NTC	0.4 W		150 Ω	RN 0005
R 48	Carbon	1/3 W	5%	5 kΩ	
R 49,50		-		33 kΩ	
R 51,52		-		4.7 kΩ	
R 53			-	10 kΩ	
R 54,55			2%	179 Ω	
R 56-59			5%	4.7 kΩ	
R 60,61				1 kΩ	
R 62,63	Metal	1/4 W	1%	270 kΩ	RF 0306
R 64,65	Carbon	1/3 W	5%	50 kΩ	
R 66-69	-		-	96 Ω	
R 128,129				400 kΩ	
R 130,131				50 kΩ	
R 132,133				100 kΩ	
R 134,135				1.34 kΩ	
R 136,137				2.5MΩ	
R 138				298 Ω	
R 139				500 kΩ	
R 140				96 Ω	
R 141,142				1 kΩ	
R 143				10 kΩ	
R 144				3 kΩ	
R 145				4.7 kΩ	

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF
R 146	Carbon	1/2 W		[illegible] kΩ	
R 147,148		1/3 W		[illegible] Ω	
R 149,150	Wire	1 W	2	2 Ω	RO 1106
R 151			5	3 Ω	RR 0003
R 153,154				1 Ω	RR 0001
R 156	Carbon	1/3 W		1MΩ	
R 171,172	Wire	5.5 W		680 Ω	RX 0317
R 173,174	Carbon	1/3 W		2.7 kΩ	
R 175,176				1 kΩ	
R 177				680 Ω	
R 178				75 kΩ	
R 179			2%	850 kΩ	
R 180				450 kΩ	
R 181			5%	320 kΩ	
R 182				10 kΩ	
R 183				50 kΩ	
R 184				190 Ω	
R 309,310		1/4 W	5%	47 Ω	RB 1470
R 311,312				18 Ω	RB 1180
R 315	-			47 Ω	RB 4470
R 316	-			4 MΩ	
V 3-5	Silicon Trans.	NPN		BC 107	VB 1032
V 8,9		NPN		BC 107	VB 1032
V 10,11		NPN		SE 1002	VB 0252
V 12,13		NPN		2 N 3053	VB 0251
V 14-17		NPN		2 N 3440	VB 0250
V 18-19		PNP		MM 4003	VB 0068
V 29		NPN		2 N 3440	VB 0250
V 30	-				VB 0087
V 31	Op. Amp.			LM 301 AN	VE 0017
V 32	Silicon Trans	PNP		2 N 4289	VB 0049
V 33,34		NPN		40407	VB 0054
V 35		NPN		40407	VB 0053
V 36		NPN		TIB 31 B	VB 0548
V 37,38		PNP		TIB 32 B	VB 0107
V 39		NPN		TIB 31 B	VB 0548
V 40		NPN		BC 107	VB 1032
V 41		PNP		2 N 4289	VB 0049
	Printed Circuit Board				XC 0529
	Heat Sink				DK 0413
	Heat Sink				DK 0414
	Heat Sink				DT 0040

Layout Diagrams with Parts List



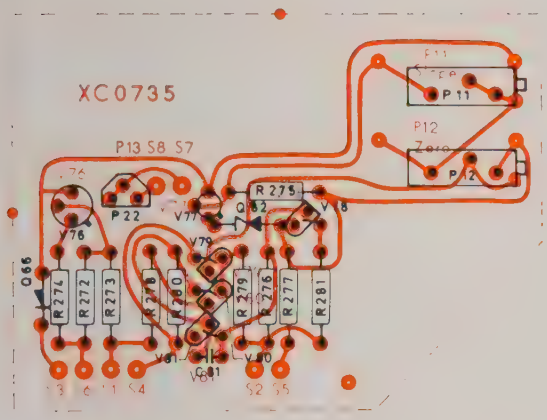
CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
C 59-63	Electrolytic			22 µF/100 V	CE 0616
C 64,65	"			100 µF/ 25 V	CE 0443
C 66,67	Ceramic			1000 pF/500 V	CK 3100
C 70,71	Electrolytic			400 µF/ 40 V	CE 0417
C 78	Ceramic			1000 pF/500 V	CK 3100
C 79	"			120 pF/400 V	CK 2121
C 83,84	"			4.7 nF/100 V	CK 0096
O 7	Mini Relay			12 V	OC 0034
O 8	Mini Relay			24 V	OC 0035
Q 43,44	Zener	53 - 50 V		IN 732 A	QV 1327
Q 45,46	"	5.6-6.0 V		ZG 5.6	QV 1107
Q 47,48	"	8.5-9.6 V/5 mA		ZF 9.1	QV 1109
Q 49-56	Silicon	400 V/1 A		1 N 4004	QV 0237
Q 76	Zener	15.3-17 V/5 mA		ZF 16	QV 1118
Q 79-81	Silicon	400 V/1 A		1 N 4004	QV 0237
Q 84,85	"	400 V/1 A		1 N 4004	QV 0237
Q 86,87	Zener	15.3-17 V/5 mA		ZF 16	QV 1118
R 185,186	Carbon	1/3 W	5%	3 kΩ	
R 187	"	"	"	10 kΩ	
R 188,189	"	"	2%	15.2 kΩ	
R 190,191	"	"	"	5.6 kΩ	
R 192,193	"	"	"	2 kΩ	
R 194,195	"	"	5%	10 kΩ	
R 196,197	"	"	"	4.2 kΩ	
R 198-201	"	"	10%	2 kΩ	
R 202,203	"	"	"	50 Ω	
R 204 207	"	"	"	1 kΩ	
R 246	"	"	5%	500 Ω	
R 247	"	"	"	360 Ω	

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
R 248	Carbon	1/3 W	5%	15 kΩ	
R 249	"	"	"	50 kΩ	
R 250	"	"	"	10 kΩ	
R 251	"	"	"	800 Ω	
R 252	"	"	"	3 kΩ	
R 253	"	"	"	12 kΩ	
R 254	"	"	"	4.2 kΩ	
R 256	"	"	10%	1 kΩ	
R 257	"	"	5%	10 kΩ	
R 258	"	"	"	10 kΩ	
R 259,260	"	"	2%	327 Ω	
R 261,262	"	"	"	100 kΩ	
R 263	"	"	5%	20 kΩ	
R 264	"	"	10%	70 kΩ	
R 265	"	"	5%	20 kΩ	
R 266,267	"	"	"	5 kΩ	
R 268	"	"	"	35 kΩ	
R 269	"	"	2%	56 kΩ	
R 270	"	"	5%	470 Ω	
R 271	"	"	"	4.7 kΩ	
R 287	"	"	"	20 kΩ	
R 288	"	"		2 kΩ	
R 289	"	"		2 kΩ	
R 290-295	"	"	5%	10 kΩ	
R 296 297	"	"	"	50 kΩ	
R 298,299	"	"	"	220 kΩ	
R 300,301	"	1/2 W	10%	1 kΩ	
R 302,303	"	1/3 W	5%	10 kΩ	
R 313,314	"	1/4 W	"	1 kΩ	RB 3100
V 42	Silicon	NPN		40407	VB 0054
V 43	"	PNP		40406	VB 0053

ZG 0069

CIRCUIT DIAGRAM REF.	COMPONENT TYPE			STOCK REF.
V 44	Silicon	NPN	40407	VB 0054
V 45		PNP	40406	VB 0053
V 46		NPN	BC 107	VB 1032
V 47,48		PNP	2 N 4289	VB 0049
V 49,50		NPN	BC 107	VB 1032
V 51		PNP	2 N 4289	VB 0049
V 65-67		PNP	2 N 4289	VB 0049
V 68-74		NPN	BC 107	VB 1032
V 75		PNP	2 N 4289	VB 0049
V 84		NPN	BC 107	VB 1032
V 85,86		PNP	2 N 4289	VB 0049
V 87		NPN	BC 107	VB 1032
	Printed Circuit Board			XC 0734
	Heat Sink			DT 0040

Layout Diagrams with Parts List

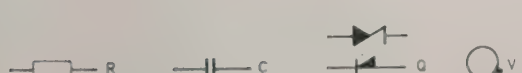


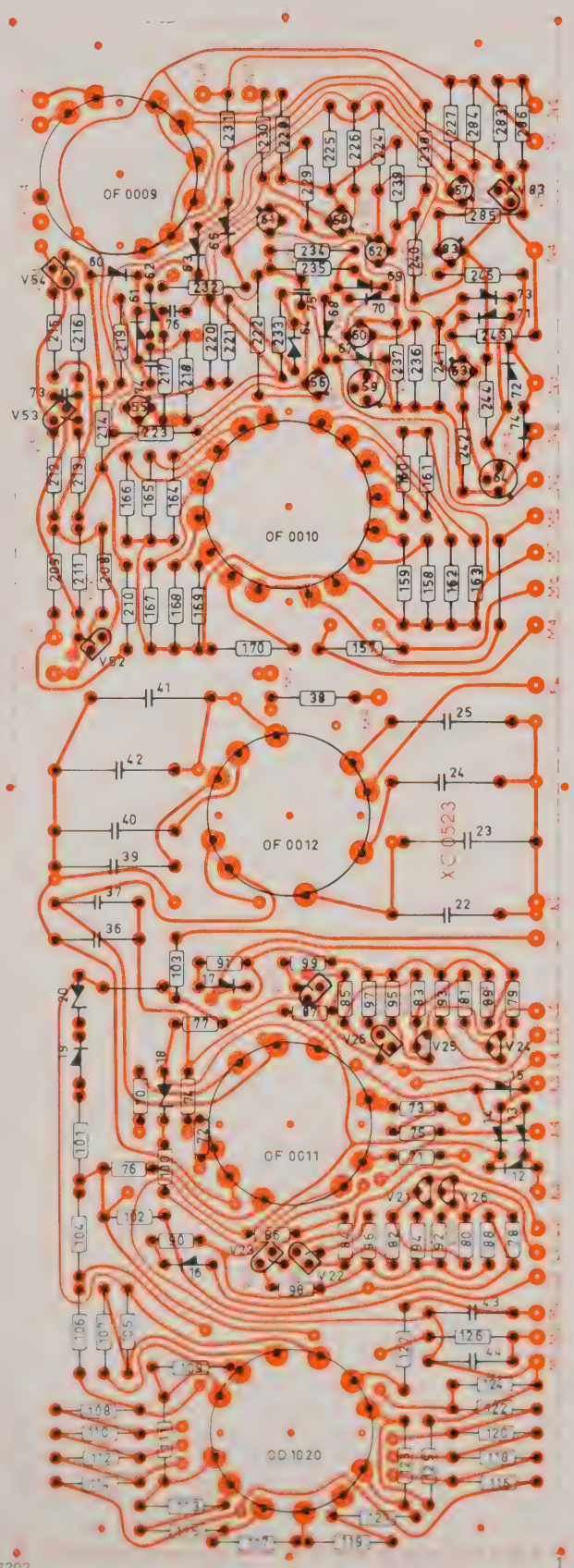
CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
C 81	Ceramic			120 pF/400 V	CK 2121
P 11,12	Wire	0.3 W		20 kΩ	PG 3204
P 13	Cermet	-		220 Ω	PG 1220
Q 82	Zener	5.6-6.0 V/10 mA		Selec. QV 1105	QV 1107
R 272	Carbon	1/3 W	2%	10.5 kΩ	
R 273	-	-	-	40 kΩ	
R 274	-	-	5%	1 kΩ	
R 275	-	-	2%	8.5 kΩ	
R 276	-	-	5%	5 kΩ	
R 277	-	-	-	2 kΩ	
R 278	-	-	-	1 kΩ	
R 279	-	-	-	20 kΩ	
R 280	-	-	-	5 kΩ	
R 281	-	-	10%	100 Ω	
V 76	Silicon	PNP		40406	VB 0053
V 77	-	NPN		BC 107	VB 1032
V 78	-	PNP		2 N 4289	VB 0049
V 79,80	-	NPN		BCW 82 B	VB 0055
V 81	-	PNP		2 N 4289	VB 0049
	Printed Circuit Board				XC 0735

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
C 82	Polycarbonate			0.22 µF/630 V	CS 0128
Q 77,78	Silicon	400 V/1 A		1 N 4004	QV 0237
R 304,305	Carbon	1/3 W	10%	100 kΩ	
R 308	-	1/4 W	5%	220 kΩ	RB 5220
V 88,89	Triac			MAC 11	VB 2501
	Printed Circuit Board				XC 0834

Layout Diagrams with Parts List

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
C 22	Electrolytic			10 µF/ 70 V	CE 0517
C 23	Polycarbonate			5.6 µF/100 V	CS 0346
C 24	-			2,2 µF/100 V	CS 0380
C 25	-			0.68 µF/100 V	CS 0342
C 36-38	Polyester			0.1 µF/250 V	CS 0013
C 39	-			0.33 µF/250 V	CS 0019
C 40	-			0.68 µF/250 V	CS 0023
C 41,42	-			2 µF/250 V	CS 0028
C 43,44	-			47 nF/250 V	CS 0009
C 72	Polycarbonate			1,5 µF/100 V	CS 0386
C 73	Ceramic			4.7 nF/100 V	CK 0096
C 74	-			47 nF/ 30 V	CK 4470
C 75	Tantalum			4.7 µF/ 10 V	CF 0018
C 76	Ceramic			22 nF/ 63 V	CK 4220
O 2	"Lower Limiting Frequency"				OF 0012
O 3	"Rectifier Response"				OF 0011
O 4	"Potentiometer Range"				OD 1020
O 5	"Writing Speed"				OF 0010
O 6	"Paper Drive Functions"				OF 0009
Q 12-15	Silicon	200 V/ 40 mA		13 P 2	QV 0022
Q 18	Zener	21.6-26.4 V/ 4 mA		1 N 723	QV 1005
Q 19	Silicon	400 V/ 1 A		1 N 4004	QV 0237
Q 20	Zener	5.0-6.0 V/		ZG 5.6	QV 1107
Q 60-63	Silicon	300 V/200 mA		1 N 4004	QV 0237
Q 64	Zener	15.3-17 V/ 5 mA		ZF 16	QV 1118
Q 65	Silicon	300 V/200 mA		1 N 4004	QV 0237
Q 67-74	-	400 V/ 1 A		1 N 4004	QV 0237
R 38	Carbon	1/3 W	5%	100 kΩ	
R 70,71	Metal	1/4 W	1%	22.1 kΩ	RF 4221
R 72,73	-	-	-	23.2 kΩ	RF 4232
R 74,75	-	-	-	18.2 kΩ	RF 4182
R 76,77	-	-	-	22.1 kΩ	RF 4221
R 78,79	-	-	-	10.0 kΩ	RF 4100
R 80,81	-	-	-	5.23 kΩ	RF 3523
R 82,83	-	-	-	2.80 kΩ	RF 3280
R 84,85	-	-	-	1.54 kΩ	RF 3154
R 86,87	-	-	-	2.00 kΩ	RF 3200
R 88,89	-	-	-	49.9 kΩ	RF 4499
R 90,91	-	-	-	45.3 kΩ	RF 4453
R 92,93	-	-	-	17.4 kΩ	RF 4174
R 94,95	-	-	-	5.23 kΩ	RF 3523
R 96,97	-	-	-	1.65 kΩ	RF 3165
R 98,99	-	-	-	511 Ω	RF 2511
R 100	Carbon	-	5%	1.8 kΩ	RB 3180
R 101	-	1/3 W	10%	100 Ω	
R 102,103	Metal	1/4 W	1%	133 kΩ	RF 5133
R 104,105	Carbon	1/3 W	2%	13 kΩ	
R 106,107	-	-	-	12.5 kΩ	





ZL 0034

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF
R 108,109	Carbon	1 3 W	.	9 kΩ	
R 110,111				6.3 kΩ	
R 112,113				5 kΩ	
R 114,115				4 kΩ	
R 116			.	2.9 kΩ	
R 118,119			.	2.1 kΩ	
R 120,121				1.9 kΩ	
R 122,123			.	1.4 kΩ	
R 124,125				5 kΩ	
R 126,127			5%	50 kΩ	
R 157		.	2%	470 kΩ	
R 158		.	.	3.6 kΩ	
R 159			.	10.5 kΩ	
R 160				25 kΩ	
R 161			.	42 kΩ	
R 162				69 kΩ	
R 163		.	.	115 kΩ	
R 164				200 kΩ	
R 165		.		350 kΩ	
R 166				630 kΩ	
R 167		.	.	250 kΩ	
R 168			.	603 kΩ	
R 169				1.4MΩ	
R 170			.	3.5MΩ	
R 208		.	5%	500 kΩ	
R 209				360 Ω	
R 210				15 kΩ	
R 211				100 kΩ	
R 212				2.7 kΩ	
R 213			2%	22 kΩ	
R 214			5%	10 kΩ	
R 215,216				30 kΩ	
R 217,218			10%	200 kΩ	
R 219			5%	10 kΩ	
R 220				100 kΩ	
R 221				50KΩ	
R 222		1/2 W	10%	1 kΩ	

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
R 223	Carbon	1/3 W	5%	20 kΩ	
R 224				10 kΩ	
R 225,226				50 kΩ	
R 227,228				10 kΩ	
R 229				20 kΩ	
R 230,231				10 kΩ	
R 232				20 kΩ	
R 233				100KΩ	
R 234				10 kΩ	
R 235				3 kΩ	
R 236				10 kΩ	
R 237			10%	2 kΩ	
R 238,239				20 kΩ	
R 240				10 kΩ	
R 241				2 kΩ	
R 242			5%	10 kΩ	
R 243				3 kΩ	
R 244				10 kΩ	
R 245				20 kΩ	
R 283,284				10 kΩ	
R 285				20 kΩ	
R 286				50 kΩ	
V 1,2	FET	N		E 102	VB 1028
V 6,7		N		E 102	VB 1013
V 20,21	Silicon	NPN		BC 174 B	VB 0537
V 22,23		NPN		2 N 4287	VB 0055
V 24,25		PNP		BC 256 B	VB 0092
V 26,27		PNP		2 N 4289	VB 0049
V 52-54		PNP		2 N 4289	VB 0049
V 55-58		NPN		BC 107	VB 1032
V 59		PNP		40406	VB 0053
V 60 63		NPN		BC 107	VB 1032
V 64		PNP		40406	VB 0053
V 82		NPN		BC 107	VB 1032
V 83		PNP		2 N 4289	VB 0049
	Printed Circuit Board				XC 0523

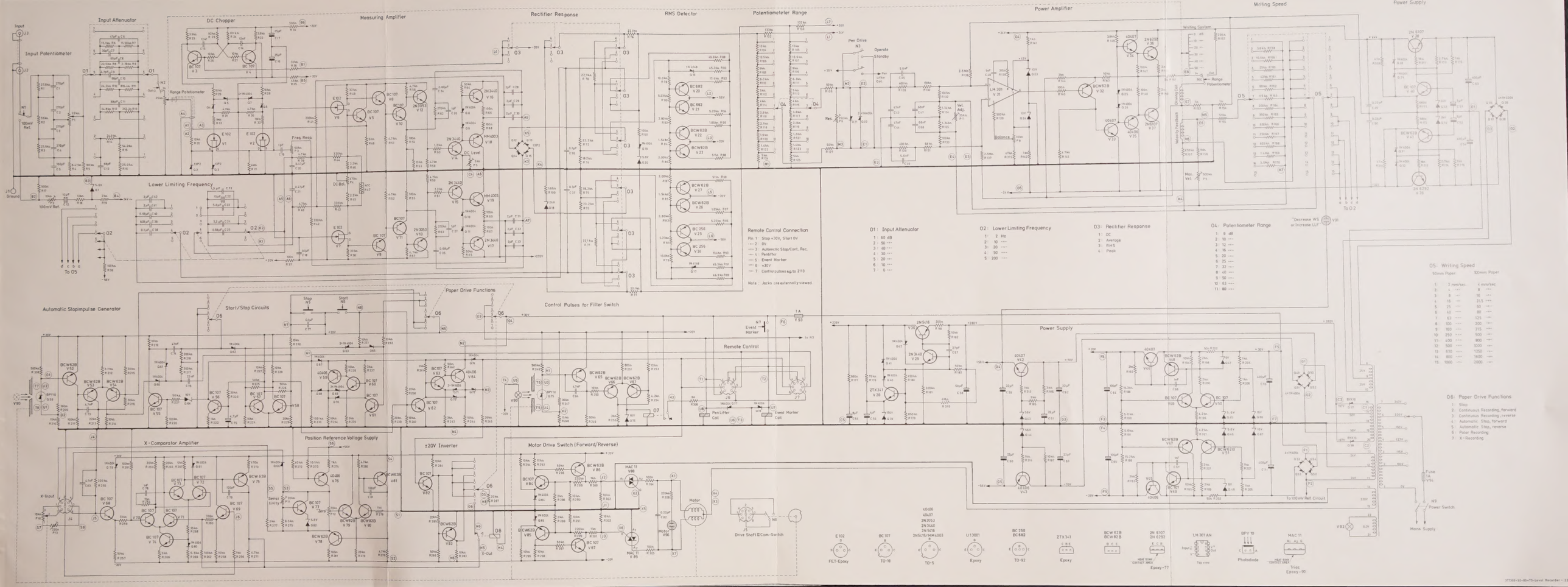
CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
C 1-4	Polystyrene			270 pF/125 V	CT 1143
C 5	-			160 pF/125 V	CT 1130
C 6	Ceramic			47 pF/400 V	CK 1470
C 7	-			30 pF/400 V	CK 0105
C 8	-			65 pF/400 V	CK 0106
C 9	-			2.7 pF/400 V	CK 0270
C 10-12	-			68 pF/400 V	CK 1680
C 58	Electrolytic			50 µF/450 V	CE 0907
C 59-61	-			32 µF/ 64 V	CE 0509
C 62,63	-			25 µF/100 V	CE 0615
C 77	Polyester			0.1 µF/250 V	CS 0013
N 1	Microswitch				NT 0033
N 3	Pen Drive				NN 0014
N 4	Microswitch				NT 0021
N 5	Stop				NT 0023
N 6	Start				NT 0023
N 7	Event Marker				NT 0023
N 9	On – Off				NN 0014
O 1	Input Ateenuator				OX 2305
O 2	Lower Limiting Freq.				OD 1026
O 3	Rectifier Response				OD 1027
O 4	Potentiometer Range				OD 1028
O 5	Writing Speed				OD 1024
					OD 1021
O 6	Paper Drive Functions				OD 1019
					OD 1025
P 1	Wire-wound lin.		2 W	2.2 kΩ	PQ 3220
P 10	- -		3.5 W	10 kΩ	PQ 3106
Q 16,17	Si. diode	75 V/75 mA		1 N 4148	QV 0216
Q 59	-	Photo			QV 0027
Q 75	-	-			QV 0027
R 1	Carbon	1/3 W	5%	27.5 kΩ	
R 2	-	-	2%	55 kΩ	
R 3	-	-	5%	27.5 kΩ	
R 4	-	-	2%	8.5 kΩ	
R 5	-	-	5%	180 kΩ	
R 6	-	1/2 W	0.5%	17.09 kΩ	
R 7	-	1/3 W	-	11.56 kΩ	
R 8	-	1/2 W	-	22.5 kΩ	
R 9	-	1/3 W	-	2.78 kΩ	
R 10	-	1/2 W	-	24.21 kΩ	
R 11	-	1/3 W	-	816.4 Ω	
R 12	-	1/2 W	-	24.75 kΩ	
R 13	-	1/3 W	-	252.5 kΩ	
R 14	-	1/2 W	-	24.92 kΩ	
R 15	-	1/3 W	-	54.28 kΩ	
R 16	-	-	-	25.05 Ω	
R 117	-	-	2%	2.9 kΩ	
R 152	Wire	5.5 W	10%	220 Ω	RX 0312
R 255	Metal	1/4 W	1%	220 Ω	RF 5220
R 306	Wire	1 W	5%	91 Ω	RO 0009

CIRCUIT DIAGRAM REF.	COMPONENT TYPE			STOCK REF.
V 28	Silicon	NPN	2 N 5550	VB 0514
V 90	Lamp			VS 0007
V 91	Neon Lamp			VS 0013
V 92	Panel Lamp			VS 8024
V 93,94	Fuse	1 A		VF 0008
V 95	FET	N	E 102	VB 1028
V 96	Neon Lamp			VS 0013

Power cord EUR	AN 0005
Power cord USA	AN 0006
Center Tap f. Polar Paper	DB 1457
Bakelite foot f. cabinet	DF 7026
Side Cover	DZ 9051
Nylon gear wheel 22-22 f. 50 Hz	DG 0233
Nylon gear wheel 20 f. 60 Hz	DG 0232
Nylon gear wheel 24 f. 60 Hz	DG 0234
Event marker stylus	DH 2003
Recording stylus	DH 2003
Recording pen	DH 2001
Paper cutter	GU 0861
Socket, coaxial Input	JJ 0108
Socket, BNC Input	JJ 0121
Socket, Ground	JT 6204
Socket, 7-pin DIN Remote Control	JJ 0709
Socket, 8-pin DIN Cam-Switch	JJ 0802
Socket, 8-pin DIN X-Recording	JJ 0802
Socket, Panel lamp	JO 0012
Plug, Coaxial Input	JP 0101
Plug, 7-pin DIN	JP 0703
Plug, 8-pin DIN	JP 0802
Mahogany cabinet	KA 0023
Mahogany cabinet for Range Potentiometer	KE 0005
Dust cover for 2307 A	KF 0036
Cam disc, short pulse	OD 0060
Cam disc, 90°	OD 0061
Inking Kit	QI 0002
Knob, 31.5 mm	SN 3207
Retaining ring for knob	DB 0850
M4 Allen screw for do.	YQ 2083
2 mm Allen key for above	QA 0043
Knob, gear shift	SN 0827
Power transformer	TN 0030
Paper guide	UA 2001
Writing system, complete	UA 2002
Gear box, complete with motor	UG 0087
Motor	UM 0020
Solenoide	UM 0023
Solenoide	UM 0024
Friction clutch	UC 0094
Magnetic drive system	UM 0801
Replacement kit for potentiometer slider	UA 0162

Printed Circuits:

XC 0115 with components	ZA 0004
XC 0833 - -	ZA 0005
XC 0529 - -	ZE 0100
XC 0734 - -	ZG 0069
XC 0735 - -	ZH 0083
XC 0834 - -	ZH 0084
XC 0523 - -	ZL 0034


Input Attenuator
DC Chopper
Measuring Amplifier
Rectifier Response
RMS Detector
Potentiometer Range
Power Amplifier
Writing Speed
Power Supply
Input Potentiometer
Range Potentiometer
Freq. Resp.
Lower Limiting Frequency
Automatic Stopimpulse Generator
Start/Stop Circuits
Paper Drive Functions
Control Pulses for Filter Switch
Remote Control
X-Comparator Amplifier
Position Reference Voltage Supply
±20V Inverter
Motor Drive Switch (Forward/Reverse)
Remote Control Connection
Pin 1: Stop +30V, Start 0V
2: 0V
3: Automatic Stop/Cont. Rec.
4: Pendifter
5: Event Marker
6: +30V
7: Control pulses eg. to 2113
Note: Jacks are externally viewed.
01: Input Attenuator
1: 60 dB
2: 50 ---
3: 40 ---
4: 30 ---
5: 20 ---
6: 10 ---
7: 0 ---
02: Lower Limiting Frequency
1: 2 Hz
2: 10 ---
3: 20 ---
4: 50 ---
5: 200 ---
03: Rectifier Response
1: DC
2: Average
3: RMS
4: Peak
04: Potentiometer Range
1: 8 dB
2: 10 ---
3: 12 ---
4: 16 ---
5: 20 ---
6: 25 ---
7: 32 ---
8: 40 ---
9: 50 ---
10: 63 ---
11: 80 ---
05: Writing Speed
50mm Paper
100mm Paper
1: 1 mm/sec
2: 2 ---
3: 4 ---
4: 8 ---
5: 16 ---
6: 32 ---
7: 63 ---
8: 100 ---
9: 160 ---
10: 250 ---
11: 400 ---
12: 500 ---
13: 630 ---
14: 800 ---
15: 1000 ---
2: 4 mm/sec
3: 8 ---
4: 16 ---
5: 32 ---
6: 63 ---
7: 125 ---
8: 200 ---
9: 315 ---
10: 500 ---
11: 800 ---
12: 1000 ---
13: 1250 ---
14: 1600 ---
15: 2000 ---
06: Paper Drive Functions
1: Stop
2: Continuous Recording, forward
3: Continuous Recording, reverse
4: Automatic Stop, forward
5: Automatic Stop, reverse
6: Polar Recording
7: X-Recording
FET-Epoxy
TO-18
TO-5
Epoxy
TO-92
Epoxy
Epoxy-77
Epoxy-90
Photodiode
Triac
Power Switch
Mains Supply
Drive Shaft & Com.-Switch
Pen Lifter Coil
Event Marker Coil
Motor